Transformation of organic polymer wastes into useful lower-molecular gases by carbon felt atmospheric pressure microwave discharge and unprecedented diamond-like carbon synthesis

T. Yajima 1; H. Yamada 1; K. Kuwahata 1; T. Koyama 1; Y. Okabe 1; K. Sugiyama 2; K. Nomura 3; H. Kurihara 4
1. Saitama Institute of Technology, Fukaya, Saitama, Japan.
3. University of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan.
4. Saitama Industrial Technology Center, Kawaguchi, Saitama, Japan.

Atmospheric pressure microwave discharge plasma (APMD) can be easily generated at a cavity between a pair of carbon felts (CF) and provide us an unprecedented reaction field with both discharge and high temperature superior to 1500 °C. In this report, the discharge plasma using carbon felts (CFAPMD) was applied to transform organic polymer wastes into useful lower-molecular gaseous products and also to synthesize diamond-like carbons (DLC). Four pieces of disk-shaped CF (40-mm diameter and 3-mm thickness) baked at 2500 °C were piled up with a ring-type ceramic spacer (2.5-mm height) between each pair of carbon felts to make cavities. Polystyrene or its derivatives were used as the carbon source for our diamond-like carbon synthesis. They were put just at the top cavity between carbon felts. The pile of carbon felts was inserted into a Pyrex glass tube reactor and set in a microwave apparatus. When the 1000 W of 2.45-GHz microwave was supplied to the reactor under nitrogen flow from the top cavity to the bottom to generate CFAPMD in the reactor tube, the carbon source material was completely decomposed into carbon and hydrogen atoms and ions by CF/APMD. Small particles thus generated flew out through the bottom CF and deposited on a substrate to form carbonaceous thin film whose Raman spectrum possessed both G and D-bands peculiar to DLC.